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Evaluation of Sirococcus Shoot Blight of Red Pine — 1973 Progress Report

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Evaluation of Sirococcus Shoot Blight of Red Pine - 1973 Progress Report

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ABSTRACT

Photographic points and plots were established in 1971 to evaluate damage to red pine by Sirococcus strobilinus Pruess. In 1973, apparent damage progressed in only 1 of the 18 large trees photographed. On the 16 plots, however, seedling mortality had increased to 40 percent on one plot and 35 percent on another. Damage was severe on three other plots, and mortality on these is predicted to exceed one third of the trees. Forest managers are advised to avoid establishing red pine regeneration under a red pine overstory.

INTRODUCTION

Sirococcus shoot blight of red pine ("Deerskin Droop"), caused by the fungus Sirococcus strobilinus Pruess, was discovered in northern Wisconsin in 1959 and the causal agent identified in 1972. The disease was found in northern Minnesota and Upper Michigan in 1970, and in New York and Ontario in 1972.

S. strobilinus (Syn: Ascochyta piniperda) has been recorded as a cause of damage to spruce, fir, and pine in Europe since 1890 (Hartig) and in the U.S. since 1914 (Graves). Outbreaks on Jeffrey and lodgepole pines and hemlock have occurred recently on the west coast on North America (Funk 1972, Illingworth 1973, Smith et.al. 1972).

On all species attacked, S. strobilinus kills the current shoots. The fungus infects by means of asexual spores, which during periods of wet weather are exuded from fruiting bodies that form on needles or stems of shoots killed earlier. Rather than being individually windborne, the spores are carried about in rain or dew which falls upon, or is windblown to healthy shoots. Apparently the germinating spore can penetrate an unwounded shoot (or, probably, a needle thereon). Once it has reached the cambial area, the fungus spreads there, causing pitching and a consequent brown stain, and usually girdles the shoot inside the bark. Occasionly the spread of the fungus within the shoot is in some way arrested, and only a few needles may die. Indications are that the fungus can also cause bud mortality.

Death of the entire tree occurs when defoliation - due to the progressive loss of shoots - reaches the point where photosynthesis is no longer sufficient to sustain the tree. Small trees beneath or close to infected large ones are readily infected and easily killed. The large trees too may eventually be killed as the fungus advances upward from branch to branch each year (Figure 1). Probably such movement occurs as spore-laden raindrops are thrown upward when the branches are tossed about in the wind.

Surveys and chance findings indicate Sirococcus shoot blight is present on at least 20,000 acres of red pine throughout the Lake States. However, there is little information as to the extent of damage the disease may cause in infected stands. Hence, an evaluation was begun in 1971.

METHODS

To evaluate the damage to individual infected trees (mostly sawtimber size), 18 photographic points were established. The trees are photographed from the same point annually and any changes noted. A tripod-mounted 35mm camera with a 50mm normal lens and Kodachrome II film is used for most photographs. For three, a 4" x 5" press camera with a 270mm lens and either Kodak Ectapan or Plus-X and Kodak Tri-X Ortho film is used. Stakes were placed at the points (center of the tripod) and their locations mapped. There are 8 photographic points on the Nicolet National Forest (established 1971), 4 on the Nett Lake Indian Reservation (established 1971), and 6 on the Superior National Forest (established 1972).

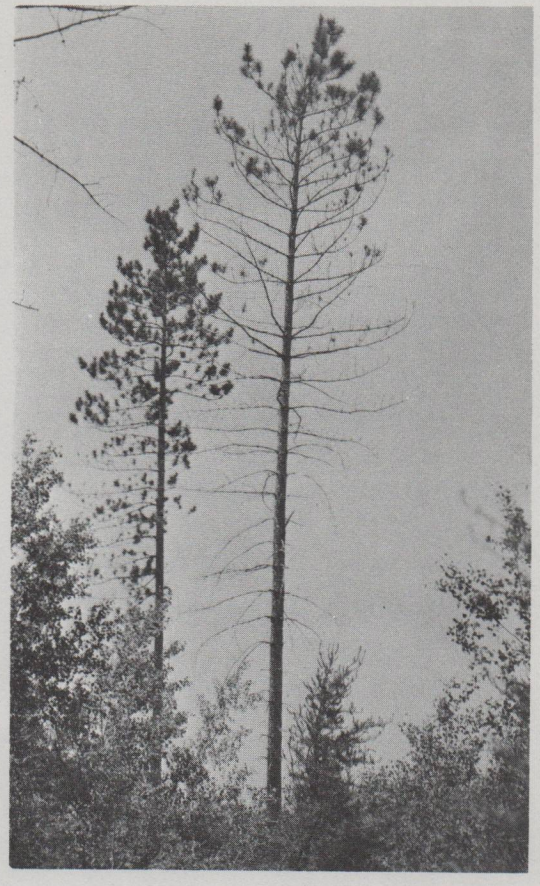

Figure 1. Red pine infected with Sirococcus strobilinus.

Damage to stands is being evaluated on 16 plots which are intended to represent a variety of conditions. The plots are listed and described in Table 1.

All trees on these plots are examined for infection and their condition (dead or alive) recorded. When practical, i.e., on trees having 100 or fewer shoots, the shoots are counted and their condition (healthy or disease-killed) recorded. On saplings with more than 100 shoots, only dead shoots are counted and the percent of shoots killed estimated. On poles and sawtimber sized trees, the dead whorls and the whorls having any dead shoots are counted. The Scott Lake plot, (established in early summer, 1971), has been examined 4 times. The Nett Lake and Tofte plots (established in late summer, 1971), have been examined 3 times, and the remaining Superior plots (established in 1972), twice.

Table 1. Description of Sirococcus shoot blight evaluation plots

Plot Location	Year Established	Stand Description	Plot Size	Plot Shape
Nicolet N.F. (Scott Lake)	1971	Poles & sawtimber over seedlings	Undetermined (≅ 1/3 acre)	Irregularly Semi-circular
Nicolet N.F. (Kimball Creek)	1971	Poles & sawtimber	1/5 Acre	Circular
Nett Lake Indian Reservation (#1)	1971	Poles & sawtimber over seedlings & saplings	1/5 Acre	Circular
Nett Lake Indian Reservation (#2 & #3)	1971	Saplings surrounded by poles & sawtimber	Undetermined (≅ 1/10 acre)	Rectangular
Nett Lake Indian Reservation (#4)	1971	Sawtimber	1/5 Acre	Circular
Superior N.F. (Tofte District)	1971	Poles & sawtimber over seedlings & saplings	1/5 Acre	Circular
Superior N.F. (Area 1 #1, #2, & #5) (Area 2 #1 & #2)	1972	One sawtimber over saplings	1/5 Acre	Circular
Superior N.F. (Area 1 #6 & #7)	1972	Saplings at least 100' away from poles or sawtimber	1/5 Acre	Circular
Superior N.F. (Area 1 #3 & #4)	1972	Poles (some saplings & seedlings)	1/5 Acre	Circular

RESULTS AND DISCUSSION

With one exception, there was no noticeable decline in the health of the trees photographed. In fact, two overtopped saplings badly damaged in 1971-72 appear to be recovering. The exception, a 70' tree on the Nicolet (Figure 1) is expected to die soon, since only a few current shoots were alive in 1973.

Results of the 1971, 1972 and 1973 examinations of the plots having red pine seedlings and saplings are presented in Table 2. About 40 percent of the trees on the Scott Lake plot and 35 percent of those on the Tofte plot are dead. Both of these plots contain seedlings and saplings overtopped by several poles and sawlog-sized trees. The trees with 90 percent or more of the shoots killed are expected to die.

Table 2. Infection of seedlings and saplings by Sirococcus shoot blight and consequent mortality.

Plot	Trees Examined	Percent Infected				Percent dead w/blight (Cum.)				Percent with 90%+ shoots infected(1973) 1/
		1971(1)*	1971(2)	1972	1973	1971(1)	1971(2)	1972	1973	
Scott Lake	329	29	80	84	95	2	9	18	40	8
Tofte District	132	-	86	98	99	-	0	19	35	21
Isabella Area 1 No. 1	173	-	-	70	73	-	-	0	4	10
Isabella Area 1 No. 2	115	-	-	91	100	-	-	0	5	30
Isabella Area 1 No. 5	105	-	-	100	100	-	-	0	7	30
Isabella Area 1 No. 6	123	-	-	98	91	-	-	0	0	0
Isabella Area 1 No. 7	82	-	-	98	100	-	-	0	0	1
Isabella Area 2 No. 1	49	-	-	98	100	-	-	0	6	37
Isabella Area 2 No. 2	65	-	-	100	100	-	-	0	2	15
Nett Lake No. 1	107 2/	-	81	83	94	-	1	1	2	1
Nett Lake No. 2	78	-	72	86	88	-	0	0	0	0
Nett Lake No. 3	76	-	55	68	74	-	0	0	0	0

* Number in parentheses refers to examination (1=early summer, 2=late summer)

1/ Dead not included.

2/ 1971 count; 8 trees had died of root rot by 1973.

Mortality greater than the 8 percent indicated can be predicted on the Scott Lake plot, since many of the trees are small. That is, if a seedling has 6 of 7 shoots infected, it is only 86% infected and would not be shown in the last column of Table 2. Nonetheless, it will probably die. Moreover, natural seedling ingrowth has appeared on the plot since 1971 and data on these seedlings were not included in the computations. Such ingrowth is common but the seedlings are usually killed soon after they appear.1/

Although losses on the Isabella plots have been light (0-7%), many trees have had 90 percent or more of the shoots killed. Consequently future mortality is likely to be high. Each of the seriously damaged plots contains a single large red pine (except Area 2, No. 2 which has two) overtopping the 10-year-old saplings. There are other large red pine as well near Area 1, No. 2 and No. 5. The relationship between damage to smaller trees and their proximity to infected larger ones can be seen in Figures 2, 3, and 4. In general damage

1/ Although records are kept for naturally seeded white pine on the Scott Lake plot, data on these seedlings are also excluded from the computations. Apparently white pine is rarely, if ever, affected by S. strobilinus.

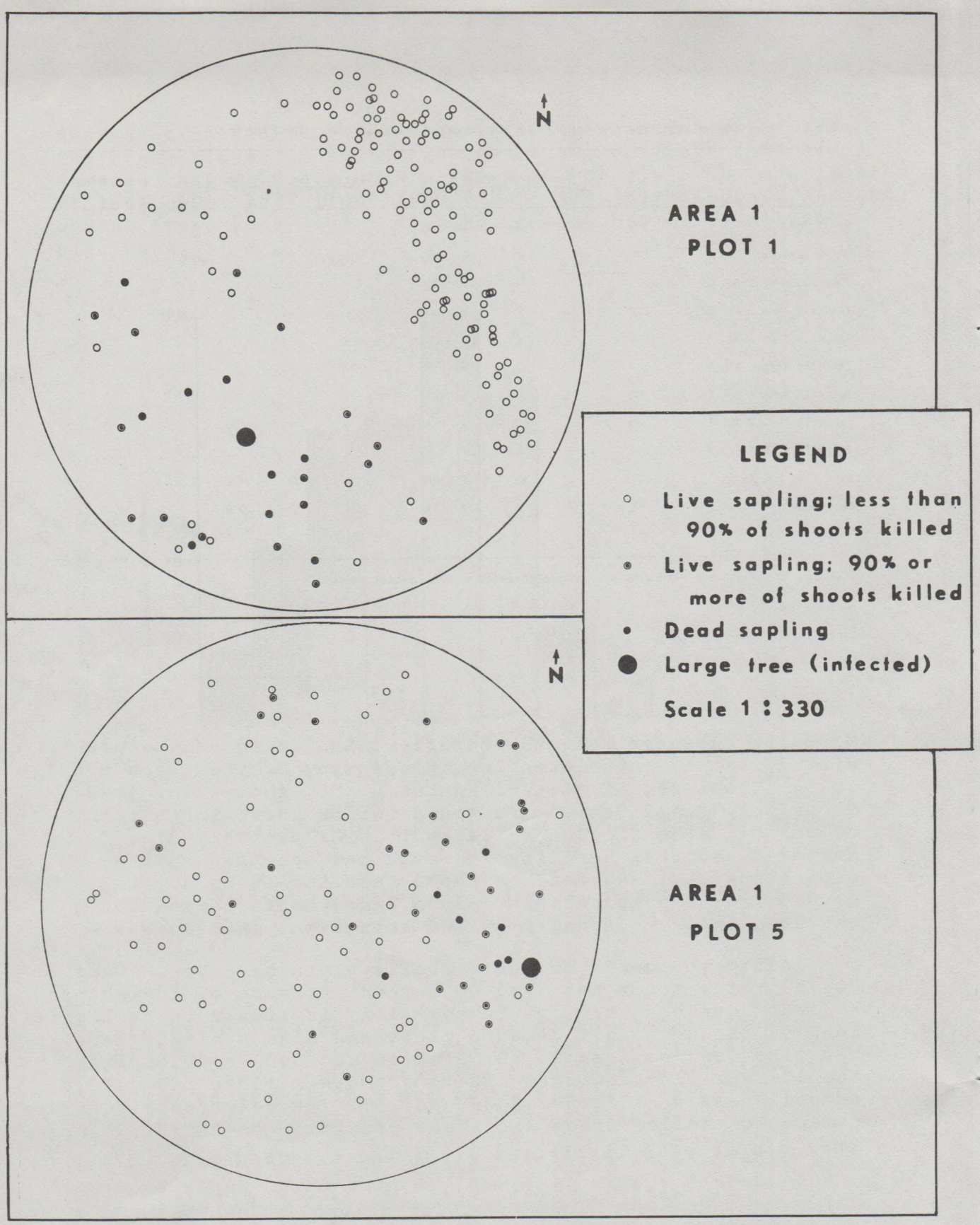

Figure 2. Maps of Isabella Sirococcus shoot blight Plots 1 and 5, Area 1, showing relationship between large infected trees and infection of nearby saplings (radii of boundary circles extended slightly).

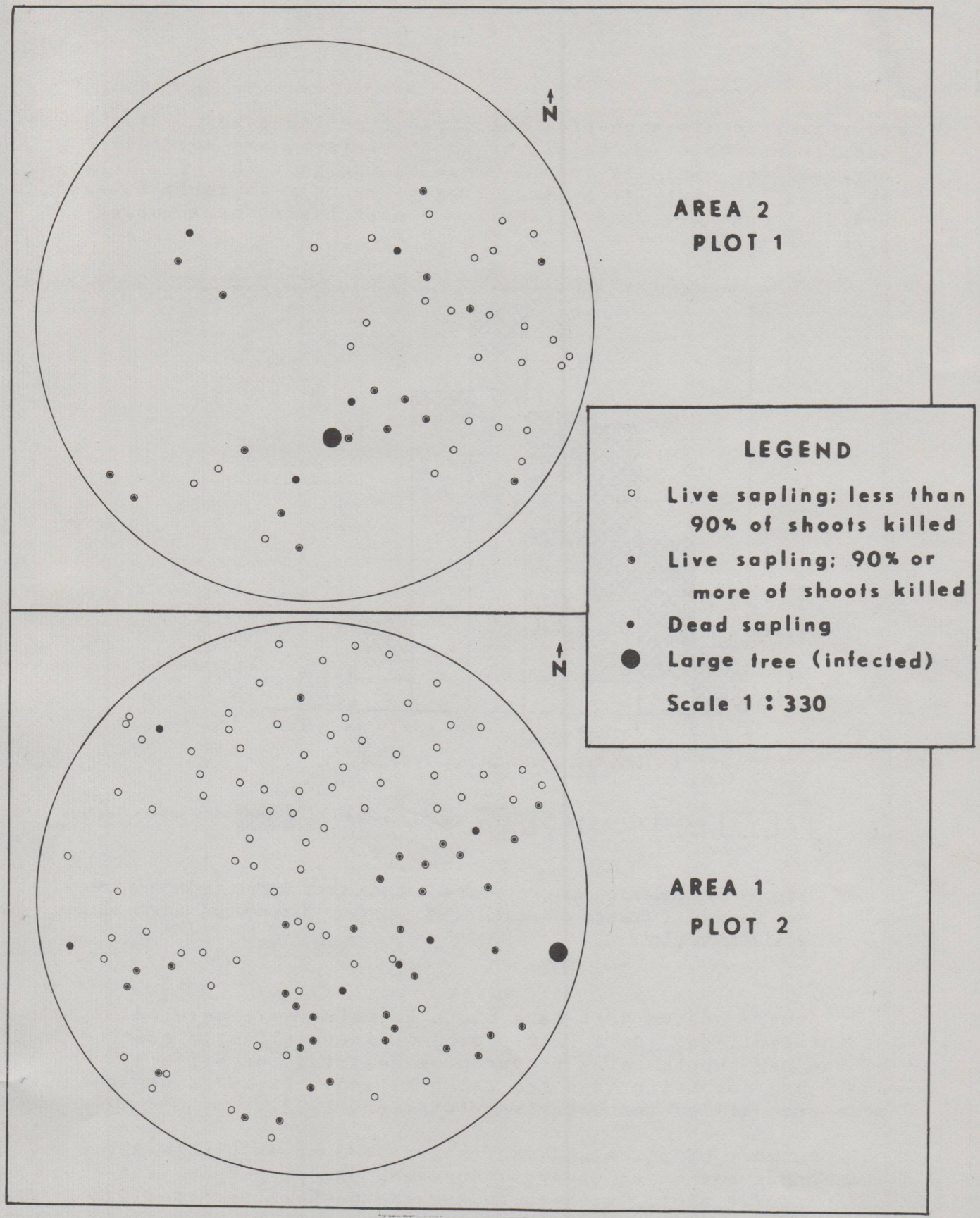

Figure 3. Maps of Isabella Sirococcus shoot blight Plot 1, Area 2 and Plot 2, Area 1, showing relationship between large infected trees and infection of nearby saplings (radii of boundary circles extended slightly).

decreases as distance from the large tree increases. Over half the trees within .6 chains, or about 40 feet, are severely damaged, and many are dead. Trees on one plot (No. 6), located at least 100' away from large trees, are only slightly damaged, and no trees have died. Plot No. 7 also has no overtopping red pine near it.

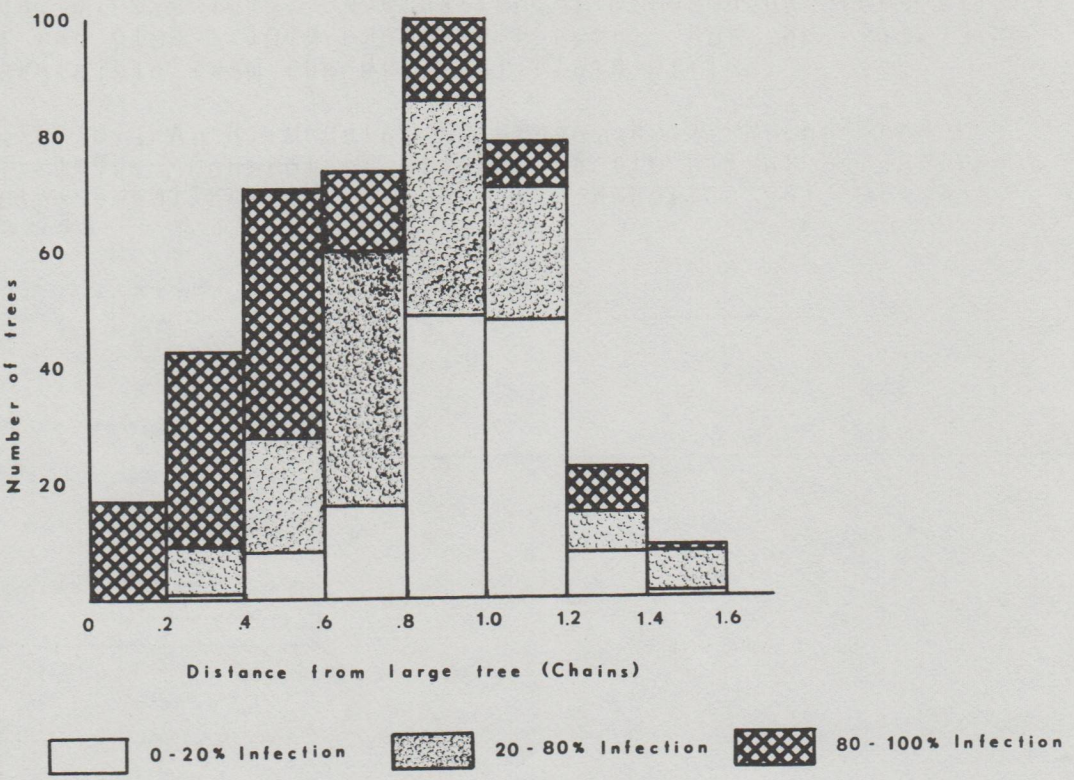

Figure 2. Relationship between distance from large infected tree and degree of damage of small trees on four Sirococcus shoot blight evaluation plots

Damage on the Nett Lake plots seems to have leveled off or declined. Data (not shown) indicate slightly more of the new shoots being produced on seedlings on plots 1 and 2 are surviving than are being killed. In 1972, somewhat more were killed than survived (O'Brien, 1973).

On most of poles and sawtimber-sized trees (Table 3), the fungus has moved upward. However, except perhaps for those on the Tofte plot, on which an average 5-whorl per tree jump occurred, these larger trees do not appear to be in serious danger at this time.

Table 3. Effects of Sirococcus shoot blight on poles and sawtimber

Plot	Trees Examined	Average Number of Whorls Affected[1] 1971	Range	1972	Range	1973	Range
Scott Lake	64	13	2-20	14	6-19	16	8-21
Kimball Creek	44	13	9-18	18	10-24	20	16-24
Tofte District	14	11	4-13	11	4-22	18	10-30
Isabella Area 1 No. 3	79	-	-	13	1-15	16	1-19
Isabella Area 1 No. 4	28[2]	-	-	11	7-13	11	7-13
Nett Lake No. 4	32	2	0-8	8	3-18	11	3-23

[1] Dead whorls plus whorls with infected shoots

[2] Only 28 of the 122 trees on plot were examined in 1973 because there was so little change from 1972.

CONCLUSIONS

It is clear that red pine seedlings and saplings near larger infected trees are likely to be killed when environmental conditions are favorable for the fungus. Therefore, planting under an overstory should be avoided. It is also clear that S. strobilinus can limit natural reproduction of red pine. Where such reproduction is desired, only uninfected trees should be left as a seed source, or any infection present should be removed. Research is needed to test methods of doing the latter.

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